

Proposed Regional Flash Flood Warning System For South Africa

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Flash Floods In South Africa

Southern Africa is a region of meteorological extremes. According to the information from CRED EM-DAT database on disasters floods, wind storms and droughts are the most important natural disasters for South Africa, with floods top of the list. Other countries in the Southern African region experience a similar pattern of disasters, although epidemics and droughts are playing a larger role in many countries.

Flooding And Flash Flooding In Southern Africa

In most countries in the region the cause of flood events are tropical in nature. Tropical cyclones are a serious threat to the countries on the eastern side of the subcontinent, particularly Mozambique. Land falling tropical cyclones also cause disastrous torrential rain over inland countries including South Africa, Malawi, Zimbabwe, and sometimes even as far as Botswana and Namibia. A casing example is the wide spread flooding due to ex-tropical cyclone Eline in 2000 over Mozambique, South Africa, Zimbabwe, Malawi, Botswana and even Namibia. Tropical lows and tropical-temperate troughs are another major source of heavy rain events over the subcontinent from December to March. In January 2006 areas over the eastern plateau experienced almost 300% of its normal January rainfall leading to extensive flooding and flash flooding in the region. Upper air troughs, associated with westerly extra-tropical weather systems, frequently cause heavy downpours particularly over South Africa.

A major contributor in South Africa to flash flooding events is the extensive escarpment areas dividing the central plateau from the coastal regions. Heavy downpours associated with the above mentioned weather systems frequently lead to small rivers to change rapidly into violent water masses with disastrous results to the communities living close to it.

Even though the South African Weather Service (SAWS) has a weather radar network, and issue warnings of potential heavy rain, a proper flash flood warning system that can warn the disaster management authorities and the communities at risk does not exist in the region. This has been highlighted as a problem area in the early warning service of the SAWS over South Africa following recent flooding events at Bredasdorp (April 2005) and Montagu (April 2003) near Cape Town. In order to mitigate the impact of disastrous flash floods on communities at risk, a proper flash flood guidance and warning system must be developed for South Africa, integrated with disaster management authorities, and rolled out into the Southern African region where possible.

Proposed Flash Flood Warning System

The short lead time of flash floods limits the effectiveness of typical hydrological run-off models. Consequently a more pragmatic approach, very similar to the Central American Flash Flood Guidance (CAFFG) system, was proposed in a meeting during 2004 in South Africa involving hydrologists, meteorologists and disaster managers. According to this approach the necessary hydrological information for each relevant quaternary river basin is pre-calculated to determine the likelihood of flash flooding in all river basins, and the amount of rain needed over the basin that will lead to overflowing of riverbanks. Quantitative precipitation estimates from real-time monitoring rain gauges, radar and satellite can then provide the necessary rainfall information to

indicate which river basins are in danger of flash floods. This information will then form the basis of providing warnings to disaster management structures.

An important component of this proposed project will be the development of a software system able to integrate the hydrological and meteorological information, produce efficient graphical information and issue relevant warnings. Possible cooperation with NOAA regarding the computer software system used in the CAFFG could be investigated.

The next challenge will be to increase the lead-time of warnings with precipitation forecasts. Research has been conducted in South Africa and other countries to do very short-range precipitation forecasts through statistical techniques of radar rainfall fields. To investigate the likelihood of increasing the lead-time beyond six hours, the use of numerical weather prediction and ensemble forecasting of quantitative precipitation forecasts (QPF) can be tested. This may lead to probabilistic forecasts and potential scenarios of flash flood occurrence and will be valuable additional advice to disaster management.

Regional Applications

Since flooding and flash flooding is a regional problem wider than South Africa, an important phase of the proposed project must be to role this system out to other countries in the region. The SAWS is a Regional Specialised Meteorological Centre (RSMC) of WMO and can thus play a pivotal role in a regional flash flood guidance system. It is essential that local scientists (meteorologists and hydrologists) of the different countries are involved in the development of the guidance system to utilize local knowledge and build capacity.